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DESCRIPTION

CONVEYING APPARATUS, INSPECTING APPARATUS AND ALIGNING AND SUPPLYING
APPARATUS

TECHNICAL FIELD

11B A2> The present invention relates to a conveying apparatus for a conveyed article inspecting apparatus for inspecting mainly a small article such as a drug medicine (a tablet, a capsule and the like), small confectionery such as a candy and the like, a washer, a button electric cell, or the like as the conveyed article in a defect inspection step, a visual inspection step, a dimensional check step or the like of the conveyed article while conveying the conveyed article, an inspecting apparatus thereof and an aligning and supplying apparatus thereof.

BACKGROUND ART

11B A3> In the case of detecting respective surfaces of the conveyed article such as the small article or the like while conveying, a plurality of linear apparatuses have been conventionally arranged in series connection so as to be capable of transferring, however, there has been a disadvantage that a wide space to be occupied is required. On the contrary, when placing the conveying apparatuses in a vertical attitude, the occupied space is reduced, however, a required height thereof is significantly increased, and since the conveyed article held by suction is sometimes inclined due to a vibration of the conveying process or on its own weight, it is hard to inspect.

11B A1> Further, the conveying apparatus for conveying the conveyed article in a linear direction is structured, for example, such that the conveyed article is mounted so as to ride over a pair of parallel belts and is conveyed

while being held by suction by a suction means through a gap between the belts, so that since the belts can not be elongated and narrowed in order to resist a tensile strength, in the case that the conveyed article mounted on the belts is a small article, side surfaces thereof are supported between the belts deeply and the side surface of the conveyed article can not be sufficiently inspected.

Further, since a conventional rotary disc is structured such that a contact portion with the conveyed article is made, for example, of an aluminum metal or the like, the contact portion is easily slipped due to a low coefficient of friction, whereby a conveying state is easily changed due to a weight of the conveyed article.

Further, the structure of this kind of rotary disc apparatus (for example, Japanese Patent Application Laid-Open No. 61-212374) is provided with movable opposing plates constituted by a pair of mutually opposing rotary discs and having a slit which is provided in peripheral portions of the rotary discs and continuously all around the periphery thereof and has an opposing gap smaller than the small article, and a suction means having a rotary tube shaft concentrically pierced in an inner side of the movable opposing plates, communicating with an inner portion of the rotary tube shaft and sucking an air from the slit to an inner side of the movable opposing plates. However, since the rotary tube shaft is provided, the air is unnecessarily sucked from the slit corresponding to a portion requiring no suction.

Further, in the case of supplying the conveyed article to the conveying apparatus, the aligning and supplying apparatus is used. The conventional aligning and supplying apparatus is structured such that the conveyed article supplied on a turn table is exposed to an aligning operation of an aligning guide together with a rotation of the turn table, and is gradually aligned

SUB A7

along a peripheral wall. The conveyed article reaching a thickness gate from the aligning guide is sorted on the border of a predetermined thickness, and the conveyed article having a thickness equal to or less than the thickness passes through the thickness gate so as to reach a width guide. The conveyed article reaching the width guide is sorted on the border of a predetermined width, and the conveyed article having a width equal to or less than the width passes through the width guide so as to be fed out to the conveying apparatus.

However, the article having the different width and thickness and being stable in a state of turning at 90 degrees, such as the tablet or the like is sorted at the thickness gate. The more a rate of the 90 degrees turn becomes, the more a number or an amount thereof sorted by the thickness gate becomes, whereby the number of the conveyed article fed out to the conveying apparatus is reduced. Accordingly, a processing efficiency is significantly deteriorated.

SUB A8

Accordingly, an object of the present invention is to provide a conveying apparatus which can stably execute a side surface inspection of a small article without requiring a lot of space, stably execute an inspection in a rotary disc apparatus and shut out an air in a portion requiring no suction.

SUB A9

Further, another object of the present invention is to provide an aligning and supplying apparatus which can improve a processing efficiency even in a small article having different width and thickness and being stable in a turned state.

INC A10

DISCLOSURE OF THE INVENTION

SUB A11

In accordance with a first aspect of the present invention, there is provided a conveying apparatus comprising:

a linear conveying portion with a suction means which sucks the conveyed article riding over a pair of parallel conveying belts through a gap between the conveying belts so as to convey the conveyed article in a state of holding the conveyed article by suction to the conveying belt, and has one end opposing to the outer peripheral surface of the rotary disc portion so as to be capable of transfer the conveyed article.

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In accordance with a second aspect of the present invention, there is provided a conveying apparatus as described in the first aspect, wherein a ring-like supporting member having a high friction coefficient is provided in both sides of the slit along the outer peripheral surface of the rotary disc.

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In accordance with a third aspect of the present invention, there is provided a conveying apparatus as described in the second aspect, wherein the linear conveying portion is constituted by a first conveying portion and a second conveying portion having the same structure, one end of the first conveying portion opposes to the outer peripheral surface of the rotary disc portion so as to be capable of transferring the conveyed article, and one end of the second conveying portion opposes to another end of the first conveying portion so as to be capable of transferring the conveyed article.

In accordance with the conveying apparatus described in the third aspect, in addition to the same effect as that of the second aspect, it is possible to inspect both of front and back surfaces of the conveyed article by the linear conveying portion.

In accordance with a fourth aspect of the present invention, there is provided a conveying apparatus as described in the third aspect, further comprising an aligning and supplying apparatus for aligning the conveyed article so as to supply to the outer peripheral surface of the rotary disc portion in an opposite side to the first conveying portion of the rotary disc portion, and an air shutting means for closing the slit of the peripheral surface portion other than the peripheral surface portion reaching the first conveying portion from the aligning and supplying apparatus in a rotational direction of the rotary disc portion.

In accordance with the conveying apparatus described in the fourth

41 1.5 aspect, in addition to the same effect as that of the third aspect, it is possible to shut the air of the slit requiring no suction in the rotary disc. Accordingly, it is possible to save a suction air amount, a blower capacity can have a margin and an energy can be saved.

41 1.6 In accordance with a fifth aspect of the present invention, there is provided an inspecting apparatus using the conveying apparatus described in the first aspect, the second aspect, the third aspect or the fourth aspect, comprising:

a side surface inspecting portion for inspecting a side surface of the conveyed article on the rotary disc portion;

a front surface inspecting portion for inspecting a surface of the conveyed article on the first conveying portion;

a back surface inspecting portion for inspecting a back surface of the conveyed article on the second conveying portion; and

a sorting portion for sorting the conveyed article in response to an inspected result.

SUB A17 In accordance with the inspecting apparatus described in the fifth aspect, in addition to the same effect as that of the first aspect, the second aspect, the third aspect or the fourth aspect, it is possible to inspect respective surfaces comprising the side surface and both the surfaces of the front and back surfaces of the conveyed article, and it is possible to sort in response to an inspected result in the sorting portion.

SUB A18 In accordance with a sixth aspect of the present invention, there is provided an aligning and supplying apparatus for mounting a conveyed article having different thickness and width and capable of being stably mounted by setting a thickness direction or a width direction to a vertical direction, respectively, comprising:

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disc

Fig. 4 is a cross sectional view of the state shown in Fig. 3;
 Fig. 5 is a side elevational view of the rotary disc portion;
 Fig. 6 is a front elevational view of the rotary disc portion;
 Fig. 7 is a partly plan view of an aligning and supplying apparatus;
 Fig. 8 is a cross sectional view of a turn table of the aligning and supplying apparatus shown in Fig. 7;

Fig. 9A is a cross sectional view along a line A-A in Fig. 7 in the case that a conveyed article has a high attitude;

Fig. 9B is a cross sectional view along a line B-B in Fig. 7;

Fig. 9C is a cross sectional view along a line C-C in Fig. 7;

Fig. 10A is a cross sectional view along a line A-A in Fig. 7 in the case that a conveyed article has a low attitude;

Fig. 10B is a cross sectional view along a line B-B in Fig. 7; and

Fig. 10C is a cross sectional view along a line C-C in Fig. 7.

544-100-100-100 A description will be given below of reference numerals described in the drawings.

Reference numeral 1 denotes a conveying apparatus. Reference numeral 2 denotes an inspecting portion. Reference numeral 3 denotes a sorting portion. Reference numeral 4 denotes an aligning and supplying apparatus. Reference numeral 5 denotes a rotary disc portion. Reference numeral 6 denotes a first conveying portion. Reference numeral 7 denotes a second conveying portion. Reference numeral 8 denotes a linear conveying portion. Reference numeral 10 denotes a turn table, and reference numeral 10a denotes a mounting surface. Reference numeral 11 denotes a conveyed article. Reference numeral 12 denotes a side surface inspecting portion. Reference numeral 13 denotes a front surface inspecting portion. Reference numeral 14 denotes a back surface inspecting portion. Reference numeral 15 denotes a width guide. Reference numeral 17

INS A702

SUBAS

A conveying apparatus 1 has an aligning and supplying apparatus 4, a rotary disc portion 5, a first conveying portion 6 and a second conveying portion 7. The first conveying portion 6 and the second conveying portion 7 constitute a linear conveying portion 8. The aligning and supplying apparatus 4 is structured such that a conveyed article 11, for example, a small article, in this case, particularly a tablet is mounted on a turn table 10, and the conveyed article 11 is aligned along a peripheral edge portion in correspondence to a rotation of the turn table 10 by an aligning guide (not shown) arranged over the turn table 10 with a slight gap and is linearly fed by a width guide 15 (mentioned below) arranged near the peripheral edge portion of the turn table 10 with a slight gap so as to be supplied to the rotary disc portion 5.

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11 on the rotary disc portion 5 one side by one side, a front surface inspecting portion 13 for inspecting a front surface of the conveyed article 11 on the first conveying portion 6, and a back surface inspecting portion 14 for inspecting a back surface of the conveyed article 11 appearing upside on the second conveying portion 7. For example, a known structure provided with a light source illuminating the conveyed article 11 and a television camera picking up an image of the conveyed article 11 is applied to each of the structures in the inspecting portion 2 (for example, Japanese Patent Application Publication No. 6-088656).

41-1123) The sorting portion 3 sorts the conveyed article 11 in response to an inspected result. The data obtained in the inspecting portion 2 is fed to a control means, for example, an analyzer or the like so as to be compared with a reference data, an analysis for obtaining an acceptable article data or a defective article data is executed, the data is transmitted to the sorting portion 3, a timing that the sorted portion 11 comes to the sorting portion 3 is taken by counting the conveyed article 11 passing through the inspecting portion 2, and the conveyed article 11 is divided into an acceptable article collecting duct and a defective article collecting duct due to a blowing such as an air pressure in the sorting portion 3 in response to the inspected result, whereby the sorting operation is executed. The known structure is employed for the structure of the sorting portion 3.

SUB A27) Fig. 2 shows a cross section of the rotary disc portion 5 with the suction means. A slit 17 is formed on an outer peripheral surface of the rotary disc portion 5, and the conveyed article 11 is conveyed in a state of being held by suction to both sides of the slit 17 by sucking through the slit 17. In the embodiment, the structure has a motor 18, a pair of rotating discs 20 and 21 mounted to a drive shaft 19 of the motor 18, opposing to

11 / 34) each other so that peripheral edges are close to each other and forming the slit 17 therebetween, for example, using plate-like discs, and a fixed suction duct 22 rotatably mounting the drive shaft 19 of the motor 18. A pair of rotary discs 20 and 21 are mounted to a tubular connecting member 60 fitted to the drive shaft 19 so as to determine an interval of the slit 17. A ring-like supporting member 23 having a high friction coefficient is provided in both sides of the slit 17 along the outer peripheral surfaces of the rotary discs 20 and 21. In the embodiment, a peripheral groove 24 is formed in each of the outer peripheral edges of the rotary discs 20 and 21, the supporting member 23 having a large friction coefficient, for example, an O-ring made of a article having an adhesive property and a buffering property, for example, a rubber or the like is attached thereto, and an interval of the slit 17 between the O-rings is set to be smaller than a size of the conveyed article 11, for example, about 1 mm. The suction duct 22 is mounted to the drive shaft 19 of the motor 18 via a bearing 25, moves the suction duct 22 close to one rotary disc 21 so as to form a gap 30 at an interval t , for example, about 0.5 mm, forms sucking holes 26 and 27 respectively communicating with opposing portions thereof, is provided with a sucking connection portion 28 on a side surface of the suction duct 22, and connects a known suction means (not shown) to the sucking connection portion 28. Accordingly, when taking out an air within the suction duct 22 by operating the suction means, a space between a pair of rotary discs 20 and 21 becomes negative pressure through the sucking holes 26 and 27, whereby the air is sucked from the slit 17 between the rotary discs 20 and 21. At this time, the gap 30 between the suction duct 22 and the rotary disc 21 achieves a seal effect due to a pressure loss of a fine interval. When mounting the conveyed article 11 such as the tablet or the like on the supporting member 23, the conveyed article 11 is

11 held by suction to the supporting member 23 due to an air pressure, and when the rotary discs 20 and 21 rotate in correspondence to the rotation of the motor 18, the conveyed article 11 moves around a circumference of the rotary discs 20 and 21 in connection with the rotation of the rotary discs 20 and 21. Accordingly, the conveyed article 11 dropped down to the rotary disc portion 5 from the aligning and supplying means 4 as shown in Fig. 1 passes through the side surface inspecting portion 12 so as to be applied to the side surface inspection while being held by suction by the slit 17, and is conveyed toward the first conveying portion 6.

SUB 12) Reference numeral 32 denotes an air shutting means. The air shutting means 32 closes the slit 17 of the peripheral surface portion 33 other than a peripheral surface portion reaching the first conveying portion 6 from the aligning and supplying apparatus 4 in the rotational direction of the rotary disc portion 5. In the embodiment, a center portion thereof is supported to the drive shaft 19 of the motor 18 via the bearing 34 and a peripheral edge portion 35 is positioned so as to close the slit 17 of the peripheral surface portion 33.

SUB 13) Fig. 3 shows an air shutting means 32. The air shutting means 32 is constituted by a substantially meniscus-shaped disc 36, a semicircular protruding portion 37 is provided in a center portion of a flat portion 36, the bearing 34 is provided in the protruding portion 37, and the bearing 34 is fitted to the drive shaft 19 of the motor 18, whereby the disc 36 is supported to the drive shaft 19. A wind guide 39 for obliquely guiding a wind at a position of the slit 17 is provided at both ends of the flat portion 36a of the disc 36. Further, a fixed plate receiving groove 40 is formed in a part of a circumferential portion of the disc 36, a pair of fixed pins 41 are provided within the fixed plate receiving groove 40 in a standing

manner, a front end of a fixed plate 45 having a thickness of about 0.5 mm is inserted and attached within the fixed plate receiving groove 40 between the fixed pins 41 through the slit 17, a long hole 46 longer in an inserting direction is formed at a rear end of the fixed plate 45, a fixing means inserted to the long hole 46, for example, a thumb screw 47 is fastened to one end of a fixed member 48, and the fixed plate 45 is fixed to a vertical base 49 (Fig. 5) via the fixed member 48 so as to be capable of adjusting. Accordingly, the air sucked by the suction means and moving forward from the slit 17 is limited to a portion of the rotary discs 20 and 21 where the disc 36 does not exist. In this case, one of the wind guide 39 faces to the aligning and supplying means 4.

Fig. 4 shows the groove 40 and the pin 41 to which the fixed plate 45 of the disc 36 is inserted.

Fig. 5 shows a state that another end of the fixed member 48 is mounted to the vertical base 49 to which the motor 18 is mounted, and the fixed plate 45 is fixed to one end of the fixed member 48 by the thumb screw 47. Reference numeral 50 denotes a fixing device for fixing the rotary disc 20 to the tubular connection member 60 (Fig. 2).

Fig. 6 is a front elevational view of the rotary discs 20 and 21.

The linear conveying portion 8 with the suction means sucks the conveyed article 11 riding over a pair of parallel conveying belts 52 through the gap between the conveying belts 52 as shown in Fig. 1, thereby holding the conveyed article 11 by suction to the conveying belt 52 so as to convey, in which one end opposes the outer peripheral surface of the rotary disc portion 5 so as to be capable of transferring the conveyed article 11. This linear conveying portion 8 is, as shown in Fig. 1, constituted by the first conveying portion 6 and the second conveying portion 7 having the same structure,

11/17/83) One end of the first conveying portion 6 opposes to another of the wind guide 39 on the outer peripheral surface of the rotary disc portion 5 so as to be capable of transferring the conveyed article 11, and one end of the second conveying portion 7 opposes to another end of the first conveying portion 6 so as to be capable of transferring the conveyed article 11. Reference numerals 6a, 6b, 7a and 7b denote a ring body winding the conveying belt 52 therearound, for example, a pulley or the like. The ring bodies 6a, 6b, 7a and 7b connect one of the first conveying portion 6 and the second conveying portion 7 to a rotation driving means. The known structure is applied to the linear conveying portion 8 (for example, Japanese Patent Application Publication No. 5-065405).

Further, as shown in Fig. 1, the aligning and supplying apparatus 4 for aligning the conveyed article 11 so as to supply to the outer peripheral surface of the rotary disc portion 5 is positioned in an opposite side of the rotary disc portion 5 to the first conveying portion 6.

5/16/89) Figs. 7 and 8 are views showing details of the aligning and supplying apparatus 4 (in this case, a rotational direction of the turn table 10 is set to be opposite to Fig. 1). The aligning and supplying apparatus 4 is structured, for example, such as to mount the conveyed article 11 having different thickness T and width W (refer to Fig. 10) and capable of being stably mounted in a state of setting a thickness direction or a width direction to a vertical direction. For example, this is a tablet in which a width is about 6 mm, a thickness is about 5 mm and a length is longer than these. The aligning and supplying apparatus 4 has a turn table 10, a width guide 15, a thickness gate 55, an aligning guide (not shown) and a peripheral wall (not shown). The turn table 10 is structured such that a sheet having a thickness of about 0.5 mm is adhered to a mounting surface 10a, and a step portion

Sur 1121) 56 having a predetermined height is provided along a peripheral edge of the mounting surface 10a. The step portion 56 is structured, as shown in Fig. 8, such that a sheet, for example, having a thickness of about 0.5 mm is adhered to an outer periphery.

The aligning guide employs a known means, and is structured such as to align the conveyed article 11 mounted on the mounting surface 10a so as to be along the peripheral edge portion of the turn table 10.

The peripheral wall (not shown) is arranged in the peripheral edge portion of the turn table 10 with a slight gap, and is structured such as to prevent the conveyed article 11 on the turn table 10 from moving out of the turn table 10 from the portion other than the width guide 15.

Sur A 30) The width guide 15 crosses to the step portion 56 so as to guide the conveyed article 11 mounted on the mounting surface 10a to the outer peripheral side from the center side due to the rotation of the turn table 10, for example, linearly, one end is positioned close to a center side of the turn table rather than the step portion 56, and another end protrudes outward from the outer periphery of the step portion 56 so as to be fixed (the fixing means is not shown). A width of the width guide 15 in accordance with the embodiment is set to a size capable of guiding the conveyed article 11 whichever of the width direction and the thickness direction is set to the vertical direction, and the conveyed article 11 aligned by the aligning guide is introduced within the width guide 15.

Sur 1131) Figs. 9 and 10 describe an operation within the width guide 15 and the thickness gate 55. Figs. 9A and 10A show a cross section along a line A-A in Fig. 7, Figs. 9B and 10B show a cross section along a line B-B in Fig. 7, and Figs. 9C and 10C show a cross section along a line C-C in Fig. 7. The thickness gate 55 is arranged in an upper side of the conveyed article

SUP A 11 1) 11 passing within the width guide 15 on the turn table 10, and has a projection portion 57 protruding toward the conveyed article 11 so as to be capable of getting down the conveyed article 11 in a high attitude on a step portion 56 without getting down the conveyed article 11 in a low attitude at a time when the conveyed article 11 moving along the width guide 15 due to the rotation of the turn table 10 rides over the step portion 56. In the embodiment, the thickness gate 55 is set to a height at which the conveyed article 11 can enter within the width guide 15 even in the high attitude, and the projection portion 57 is provided in one side of the width guide 15, that is, an opposite side to a side from which the step portion 56 progressively enters, so as to protrude such a degree as to contact with a side surface at an upper end of the conveyed article 11 in the high attitude, thereby getting down the conveyed article 11.

SUP A 32 Figs. 9A, 9B and 9C show a state in which the conveyed article 11 in the high attitude, that is, the tablet is mounted on the turn table 10 by setting the width direction to the vertical direction, and Fig. 9A shows a state in which the conveyed article 11 is introduced within the thickness gate 55 and the width guide 15. Fig. 9B shows a state in which the step portion 56 moves forward to about half in the width direction so as to press the side portion in the mounting side of the conveyed article 11 while the conveyed article 11 moves along one side wall of the width guide 15 due to the rotation of the turn table 10, whereby the upper end side surface of the conveyed article 11 is brought into contact with the projection portion 57 so as to be tilted in a get-down attitude. Fig. 9C shows a state in which the step portion 56 completely enters within the width guide 15. At this time, the conveyed article 11 rides over the step portion 56, and the conveyed article 11 simultaneously gets down on the step portion 56 so as to become in the

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Thereafter, as shown in Fig. 7, the conveyed article 11 further moves along the width guide 15, drops down from the peripheral edge portion of the turn table 10 and drops down on the slit 17 of the rotary disc portion 5 so as to be held by suction.

Sur A 32)

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In accordance with this embodiment, since the apparatus is constituted by the rotary disc portion 5 and the linear conveying portion 8, it is possible to stably convey with saving a space even when arranging the linear conveying portion 8 horizontally, and it is possible to execute the side surface inspection of the conveyed article 11 conveyed on the rotary disc 5.

As is different from the conveying belt 52 of the linear conveying portion 8, since it is possible to fix the supporting member 23 to the peripheral edge of the rotary disc portion 5 and it is possible to reduce the cross sectional area of the supporting member 23, it is possible to stably inspect the conveyed article 11 without working against the side surface inspection of the conveyed article 11 and without slipping the conveyed article 11. In particular, when the supporting member 23 is constituted by a structure having a buffering property and an adhesive property, for example, an O-ring, it is possible to convey at a high speed and stably.

It is possible to inspect both of the front and back surfaces of the conveyed article 11 by the linear conveying portion 8.

It is possible to shut the air in the portion of the slit 17 requiring no suction in the rotary disc 5. Accordingly, it is possible to save a suction air amount, a blower capacity can have a margin and an energy can be saved.

It is possible to inspect each of the side surfaces and both of the front and back surfaces of the conveyed article 11, and it is possible to sort in correspondence to the inspected result by the sorting portion 3.

It is possible to align all the small articles having the different width W and thickness T and stabilizing under the turned state in the low attitude, and it is not necessary to sort, so that it is possible to improve a processing efficiency.

INDUSTRIAL APPLICABILITY

SUB A3

In accordance with the conveying apparatus described in the first aspect of the present invention, since the apparatus is constituted by the rotary disc portion and the linear conveying portion, it is possible to stably convey without requiring a lot of space even when the linear conveying portion is arranged horizontally, and further it is possible to execute a side surface inspection of the conveyed article conveyed in the rotary disc.

In accordance with the conveying apparatus described in the second aspect of the present invention, in addition to the same effect as that of the first aspect, it is possible to fix the supporting member to the peripheral edge of the rotary disc portion being different from the conveying belt in the linear conveying portion and it is possible to make a cross sectional area of the supporting member small, so that it is possible to stably inspect the conveyed article without working against the side surface inspection of the conveyed article and without slipping the conveyed article. In particular, when the supporting member is constituted by a structure having a buffering property and an adhesive property, for example, an O-ring, it is possible to convey at a high speed and stably.

SUB A4

In accordance with the conveying apparatus described in the third aspect, in addition to the same effect as that of the second aspect, it is possible to inspect both of front and back surfaces of the conveyed article by the linear conveying portion.

SUB A41

In accordance with the conveying apparatus described in the fourth aspect, in addition to the same effect as that of the third aspect, it is possible to shut the air of the slit requiring no suction in the rotary disc. Accordingly, it is possible to save a suction air amount, a blower capacity

MP A41)

can have a margin and an energy can be saved.

MP A42)

In accordance with the inspecting apparatus described in the fifth aspect, in addition to the same effect as that of the first aspect, the second aspect, the third aspect or the fourth aspect, it is possible to inspect respective surfaces comprising the side surface and both the surfaces of the front and back surfaces of the conveyed article, and it is possible to sort in response to an inspected result in the sorting portion.

MP A43)

In accordance with the aligning and supplying apparatus described in the sixth aspect, it is possible to align all the small articles having the different width and thickness and stabilizing under the turned state in a low attitude, and it is not necessary to sort, so that it is possible to improve a processing efficiency.